Conflicting Viewpoint Relational Database Querying: an Argumentation Approach

(Extended Abstract)

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ABSTRACT

Within the framework of the European project EcoBioCap, we model a real world use case aiming at conceiving the next generation of food packagings. The objective is to select packaging materials according to possibly conflicting requirements expressed by the involved parties (food and packaging industries, health authorities, consumers, waste management authority, etc.). The requirements and user preferences are modeled by several ontological rules provided by the stakeholders expressing their viewpoints and expertise. Since several aspects need to be considered (CO2 and O2 permeance, interaction with the product, sanitary, cost, end of life, etc.) in order to select objects, an argumentation process can be used to express/reason about different aspects or criteria describing the packagings. We define then in this paper an argumentation approach which combines a description logic (DLR-Lite) within ASPIC framework for relational database querying. The argumentation step is finally used to express and/or enrich a bipolar query employed for packaging selection.

Categories and Subject Descriptors

D.2.11 [**Software Engineering**]: Software Architecture

Keywords

Argumentation; decision support system; description logics and DLR-Lite; application within the EcoBioCap project.

1. INTRODUCTION

Within the framework of the European project EcoBioCap (www.ecobiocap.eu) about the design of next generation packagings using advanced composite structures based on constituents derived from the food industry, we aim at developing a Decision Support System (DSS) for packaging material selection. The DSS will consist of two steps: (1) aggregating possibly conflicting needs expressed by several parties involved in the considered field and (2) querying a database of packagings with the resulting aggregation obtained at point (1). The problem at hand does not simply consist in addressing a multi-criteria optimization problem [4]: the domain experts would need to be able to justify why a certain packaging (or set of possible packagings) are chosen. Argumentation theory in general [8, 3, 11] is actively pursued in the literature, some approaches even combining argumentation and multi criteria decision making [2].

We rely in this work on a logical structured argumentation system [1, 10, 9] since it (i) allows the expression of logical arguments as a combination of facts and inference rules, (ii) defines attacks and defeat relations between arguments based on a logical conflict notion. Stakeholder's set of arguments i is then modeled as concepts, facts and rules to build a partial knowledge bases $\mathcal{K}_{\mathcal{I}_i}$. The union of every stakeholder knowledge base $\mathcal{K} = \bigcup_{i=1,\ldots,n} \mathcal{K}_{\mathcal{I}_i}$ will be used to instantiate the ASPIC [1] argumentation system. The solution developed in this paper is to instantiate for each criterion, called viewpoint or aspect, an argumentation system to reason about arguments solely expressed on it. This will then be used to generate the query on the packaging database. The main contribution of this paper is to demonstrate the use of argumentation in a real world industrial scenario within the EcoBioCap project. To this aim we show how to instantiate ASPIC with the DLR-Lite logic modeling expert ontologies in this real world scenario.

2. CONTRIBUTIONS

The main contributions of the paper are the following:

1. A DLR-Lite [7, 5] ontology extended to a negation to express stakeholders' arguments about packaging characteristics as combination of concepts (defined as m-ary relations connected to a database) and inference rules (specified as subsumptions). The language is detailed in the technical report [12],

2. An instantiation of ASPIC argumentation system AS with the proposed DLR-Lite logical language. The instantiated ASPIC AS satisfies the rationality postulates [6], please see details in [12],

3. The study of the influence of the modeling rules on the argumentation results. We showed the limitation of the crisp split of the inference rules into *defeasible* and *strict*, and we propose to overcome this limitation a viewpoint approach in which arguments are gathered according to packaging aspects. Each viewpoint delivers subsets of non-conflicting arguments supporting or

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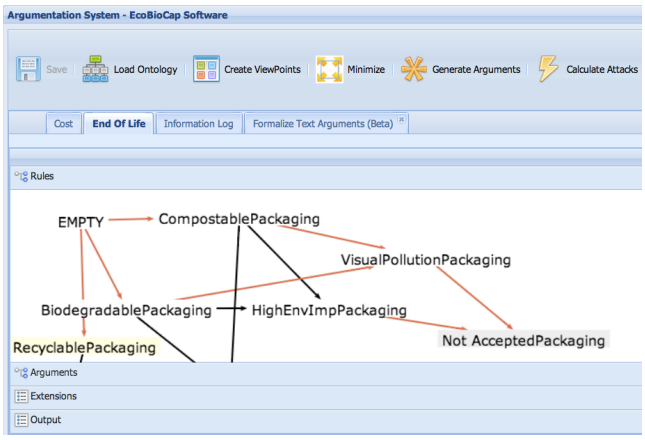

Figure 1: The user interface of the system.

opposing a kind of packaging according to a single aspect (respiration parameters, cost, materials, sanitary, end elf life, etc.),

4. The use of the argumentation results for a bipolar querying of the packaging database. Indeed, we can gather the results onto positive and negative collections. We can then deduce automatically such queries from the collections the users formed during the argumentation process. We can also carry out an analogical reasoning by generalizing results obtained from an argumentation process applied upon instances, where an instance of the sought objects can help to better understand the involved stakeholders' needs and then to be able to express, based on arguments pros and cons, a query reflecting the way objects should be selected from a database,

5. Implementation of the approach within the EcoBioCap project (www.ecobiocap.eu). A java GXT/GWT web interface was developed and a open version is accessible on *pfl.grignon.inra.fr/EcoBioCapProduction/*. The main difficulties encountered were the translation of text arguments into DLR-Lite formal representation. In the freely available version, stakeholders' arguments are provided as a manually built XML file specifying viewpoints and rules. The system generates then arguments and attacks and computes the extensions (stable, preferred, admissible, grounded, naive, etc. semantics) inside each view. Figure 1 shows the main interface of the application and a fragment of rules formalizing an argumentation scenario about the aspect *end of life* of packagings. Stakeholders argued about biodegradability, recyclability and compostability (the test XML file is accessible on *https://docs.google.com/file/d/0B0DPgJDRNwbLR2RjWWhwMjgwVEU/edit?usp=sharing)*.

3. CONCLUSION

We applied in this paper an argumentation approach on a real use case from the industry, based on a combination of ASPIC *AS* with a DLR-Lite specifications allowing stakeholders to express their preferences and providing the system with concepts and subsumptions in the packaging domain. We have proposed an argumentation system in which each criterion is considered as a viewpoint in which stakeholders express their arguments in homogenous way. The set of non conflicting viewpoints are then gathered according goals, to form consistent collections which support/oppose them.

We plan to extend the proposed approach to fuzzy argumentation to make it possible to deal with vague and uncertain concepts and rules by exploiting the fuzzy interpretation of the fuzzy DLR-Lite. Another line to develop consists of studying the bipolarity in our context of argumentation.

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